

**Deficient Attentional and Inhibitory Control with associated Neurophysiologic
Abnormalities of Frontal Area and Anterior Cingulate Cortex in ASD children**

LEUNG, Shuk Yin Connie

A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Psychology
in
Clinical Psychology

The Chinese University of Hong Kong

November 2009

Thesis / Assessment Committee

Professor Patrick Wing-leung Leung (Chair)

Professor Agnes Sui-yin Chan (Thesis Supervisor)

Professor Helene Hoi-lam Fung (Committee Member)

Professor Virginia Chun-nei Wong (External Examiner)

ABSTRACT

Objectives:

To investigate neurophysiologic abnormalities in frontal and anterior cingulate cortex underlying attentional and inhibitory control in children with Autism Spectrum Disorder (ASD).

Methods:

20 children with high-functioning ASD [Mean Age (SD): 10.75 years old (2.07 years); Mean IQ(SD): 101.4 (16.8)] and age- and IQ- matched normal children (NC) [Mean Age (SD): 9.80 years old (1.88 years); Mean IQ (SD): 110.7(17.8)] were investigated electrophysiologically during performance of a visual Go/NoGo task. An electrophysiological source localization method was employed to further analyze the data. Several different neuropsychological tests were also performed to provide behavioral measures on attention and inhibition.

Results:

ASD children showed a significantly task-related lower frontal theta activity. This effect was associated with a significantly reduced activation of the anterior cingulate cortex (ACC). Both groups also differ significantly regarding the behavioral aspects of attention and inhibition.

Conclusion:

The results suggest that ASD children have deficits in attentional and inhibitory control. Frontal dysfunction and weak ACC engagement in ASD were supported as the underlying neuronal inefficiency.

摘要

目的：

過往的研究曾指出，自閉症兒童的行為問題源於腦神經網絡的失調。本研究是探討自閉症兒童在專注及抑制功能上腦電波的異常狀況。

方法：

二十位智力正常的自閉症兒童及二十位年齡與智力水平相約的正常兒童參與研究，他們的平均年齡為十歲，研究智能屬於合齡程度。研究在電腦研究活動(Go/NoGo)進行時，會同時錄取被試者的腦電波數據，並運用根源定位方法來分析所收集的數據。研究並會使用其他幾項腦功能測試來量度兒童的在行為上的抑制能力。

結果：

Go/NoGo 活動的表現結果顯示，自閉症兒童的大腦前額葉在 theta 波段上的活動顯著地低於正常兒童的平均水平，並同時連繫著顯著地低的前額葉及前扣帶皮質活動。在多項腦功能測試來量度專注及抑制能力行為指數上，自閉症兒童與正常兒童表現也有相當差距。

總結：

結果顯示，自閉症兒童呈現專注及抑制能力上的缺失，在一般的反應控制上亦有缺失。大腦前額葉和前扣帶皮質的活動失調可能是失效原因。

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my teacher, Professor Agnes S. Chan. She has been my precious mentor for over a decade. Not only does she untiringly guide me on conducting a research with logical thinking, she has done so much beyond words can express. She had come to my working place to coach neuro-assessment, visit needy people in hospital together and advise on neuro-rehabilitation. Her altruistic attitude towards the others and her commitment to the neuropsychological field has greatly inspired me in my pursuit of knowledge. My special thanks to Professor Virginia CN Wong also for her sincere support in my study and her demonstrated unfailing love to the children with Autism Spectrum Disorder (ASD) and their families. I am also very grateful to Professor P. Leung and Professor H. Fung for their generous help and valuable comments, and also to the clinical psychology team in Hong Kong West Cluster, Hospital Authority for their kindness in work re-arrangement during my work absence. I would like to express my sincere thanks and appreciation to all my neurolab members, in particular, Sophia Sze and Yvonne Han, for their greatest help and support throughout the process of present research. My debt goes to all the ASD children and their families whom I have opportunities to work with over the past 20 years, for trusting me and sharing with me their successes and difficulties. They taught me a lot indeed. Lastly, my applause goes to my family members for their unconditional love and understanding, for their tolerance over my absent weekends and a pre-occupied mind. This dissertation is dedicated to my husband, Manus, my daughters, Kristie and Kazia, and my dear sister, Winnie.